BIO-DYNAMICS

A periodical furthering soil conservation and increased fertility in order to improve nutrition and health.

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SOIL BUILDING VERSUS NUTRIENT SOLUTION

EHRENFRIED E. PFEIFFER

In comparing today's conditions of citrus culture in Florida with those of twenty-five years ago, one has the impression of a successful comeback from a rather doubtful position to a prosperous growth. The citrus tree has become an example of calculated feeding with nutrients. These nutrients are applied at the times when they are supposed to be most effective: to stimulate foliage with nitrogen (N), to stimulate blossom and fruit setting with potash (K) and phosphates (P), and to stimulate juice formation and fruit growth, potash again playing a great role. Inasmuch as it has been observed that foliage can absorb nutrients from solutions, the leaf-spraying of such solutions has begun. The peculiarity of Florida soils lends itself favorably to these practices. Some are so sandy and poor that a kind of forced feeding is necessary. Others, like the muck soils, have an abundance of organic matter and nitrogen but a deficiency of minerals, especially potash, and are distinctly imbalanced. The prevalent use of so-called NPK fertilizers has brought the trace mineral problem into existence. Boron, manganese, molybdenum, etc., are in the foreground, because at first the NPK formulations did not contain these trace minerals and therefore the intensive use of NPK fertilizers has created a trace mineral deficiency or a tying down of them, which is now in the process of being corrected.

The same point of view — of forced feeding — is applied to vegetable cultivation. Wherever water is available in abundance — by rainfall and/or by high ground water level or by irrigation — the NPK-plus-supplements theory seems to be triumphant.

We talked with growers and agronomists. NPK and formulas such as 10-6-6, 5-7-14, 6-8-8 and 5-7-5 were the slogan. Very little was said about the soil, its soil life, how to hold the soil or to build it up, but it was often stated that the situation as it has developed resembles a hydroponic culture.

In hydroponics, plants grow in a nutrient solution. Sand, vermiculite or other inert materials serve as a medium just to give the roots a hold. The formula of mineral nutrients can be geared to the requirements of the plant. Here, too, emphasis is laid on easily available nutrients of the NPK group, but soon it was observed that these plants were not complete and, more recently, hydroponic cultures were supplemented with trace min-

erals. The control of acidity and alkalinity (pH) is important in hydroponics in order to avoid damages. Especially fast-growing crops, leafy vegetables and carrots, with a short vegetation period of only 50 to 60 days, lend themselves to hydroponics. Whether the plants thus raised are exactly the same as others grown in rich fertile soils, with regard to strength, health, viability of seeds, protein quality and vitamin content, is an open question not sufficiently investigated, but in the literature we find the claim that a complete supplementation with trace minerals will also support the protein and vitamin production.

Some problems have shown up too, and have increased. These are taken in stride, since science seems to find an answer in due time by way of sprays against almost everything — pesticides and weedicides. Were it not for the fact that some of these sprays are toxic and that toxic residues adhere to the crops, everybody would be happy. However, the number and amount of sprays and the need for them has increased tremendously. We saw potato crops which are sprayed every fifth day for one reason or another. Nematodes, of which there are several hundred species, have changed their pattern of life. A few species have become malignant and attack roots. These obnoxious species were at one time harmless, for they could live on the organic matter and soil life. The increase of inorganic fertilizers, that is, of easily available mineral nutrients, has caused them to feed on the roots. Fresh, raw manures, because of their quick decay and release of ammonia, also seem to favor the spread of nematodes. Sterilization of soils has come into vogue, thus removing the natural soil life which could offer a natural protection.

This writer now looks back over thirty-five years of association with agriculture. He has sponsored, practiced and observed in the field and in the laboratory the application of the bio-dynamic method and has studied soils and crop production in this country as well as abroad. He has seen a time when no sprays were necessary, a time when one, two or three sprays were used, as against eleven to seventeen sprays of all kinds per season nowadays. He has also seen that soils which were treated bio-dynamically, with the fostering of soil life, organic matter and balance, remained free of obnoxious nematodes; did not display the need for an increase of sprays; in fact, could be kept free from the need of sprays.

He has been particularly impressed by certain figures published in agricultural statistics. These figures come from the Bureau of the Census and Technical Bulletin No. 1082 USDA. Using the period of 1935-1939 as a basis (= 100), the figure for 1954 was: for fertilizers, a little over 250; for insecticides and fungicides, almost 150, while the acreage yield, although increased, was below the figure of 150. Today the spread is even greater. The increase of yield per acre, on the average, above the pre-World War II level, is about 30%; the increase of fertilizers per acre brings the figure for them to almost four times what it was. Insecticides, pesticides and weedicides have increased to such an extent that they surpass the outlay for fertilizers. It is pointed out in official statistics that manpower per acre has decreased. While in the last century 50% of the population was engaged in agricultural production, the figure dropped to 18% some 20 years ago and has now reached a level of 12% or even lower today. This is considered progress. However, not taken into consideration is how much of an increase of manpower is involved in the manufacturing and selling of agricultural chemicals of all kinds or the increase of man or brainpower in research, experimental stations, etc. The shift of structure is obvious. It is true that the individual farmer today works a larger acreage, but he also has a considerably larger amount of industrial and scientific labor working for him to supply him with, let us call it, unavoidable production needs. Spraying has become such a complex problem that many commercial outlets do it for him, for he would have neither the time, nor could he afford the equipment, to do it himself. In orchards and large vegetable production, picking crews are brought in where the farmer or grower used to work by himself. Fertilizers and lime are spread directly by agricultural services where the farmer used to do it himself. All this has changed the pattern of agriculture. Last but not least, the cost of keeping up with all these blessings of an industrialized agriculture has gone up considerably.

Fundamentally, most of these changes owe their existence to a certain concept, namely, the so-called Liebig theory and its application. The German agricultural chemist, Justus v. Liebig (1803-1873) had discovered the need of plants for nitrogen, phosphate and potash compounds. To these were added later on the need for lime, calcium and magnesium. Thousands of experiments were made to prove this point of view. Even

today, many research stations still try to prove or illustrate this point. More research along these lines has been done and more publications have been issued to support the NPK theory than for probably all other phases of agriculture put together. Only the development of pesticides and insecticides and certain genetic problems recently begin to measure up to the fertilizer concept.

The knowledge of the NPK, calcium, magnesium and trace mineral requirements is best observed and controlled in closed systems, such as Mitcherlich vessels, and in nutrient solutions, that is, hydroponic culture, supported by plot tests. In fact, this is the tendency we observe today, as described above — to enlarge the test plot and the hydroponics philosophy and to subject all of agriculture to this concept. This, at present, is the majority opinion, so forcefully brought forward that only few have the courage to have another viewpoint.

Wherever and whenever a soil lends itself, because of natural conditions, to being treated like a hydroponic system, the theory seems to be successful. Especially on light and sandy soils and poor soils nearest to the sand-vermiculite condition of a nutrient solution system, this theory seems to work. The concept gained through experiments with nutrient solutions looks upon the soil as a carrier of nutrient solutions. Easily available, even water soluble fertilizers, are called for. The terms of agricultural legislation — to report the NPK percentages and to emphasize the contents of a fertilizer bag with regard to soluble and available minerals—meet this theory. However, what is determined by analysis is strictly a matter of laboratory method; available and soluble have, in many cases, little to do with the actual process and changes of fertilizer assimilation or utilization in the soil. The soil is a dynamic system. At the moment the fertilizer is applied, this dynamic system takes over and changes occur. There are the effects of washing out, leaching. It is obvious that the water soluble element is in greater danger of leaching; therefore an excess of it has to be applied. The problem is quite complicated.

Potash is a type of water soluble fertilizer that is subject to leaching. Easily soluble potash salt, under certain conditions, is absorbed readily by plant roots and leads to so-called luxury consumption, so that plants, especially grasses and legumes, absorb a much greater amount (up to six times more) than they really need. This results in severe imbalances of the

plant metabolism; that is, the way the plants are being built up. These effects do not always show up at once. But it was observed that animals feeding on forage produced by luxury consumption suffer from unexplainable illnesses. The milk from cows thus fed will not curdle properly and will not make cheese. In Switzerland, the farmer was advised not to use easily soluble potash or nitrogen sources on pastures in the spring but only in the fall (apparently with the hope that the excess will be washed out during the winter).

An excess of nitrate also is absorbed and remains as nitrate or nitrite in plants, causing severe disturbances when fed. Excesses of ammonia, nitrate and nitrite from fertilizer sources, from raw manures as well as from garbage dumps, have been washed into watersheds and have contaminated the ground water.

In this regard, it is interesting to discover that the hydroponic and nutrient solution culture can provide an important lead. Already before 1940, the Polish soil scientist, Niklewski, showed that colloidal humus had an extremely beneficial effect upon root growth. This writer has made many studies concerned with adding humus and humus solutions to hydroponic and nutrient solutions and was able to observe that the composition of plants and the formation of fine hair and feeder roots were different as a result. In fact, humus added to hydroponic cultures will produce two to three times as many roots as compared with the growth in mineral nutrient solutions alone. The addition of humus, therefore, offers a chance of improving the utilization of nutrients. This type of research is far from being sufficiently explored as yet.

On one of the farms in Holland which this writer operated before the war and which has continued to use the bio-dynamic concept since, a 20 years' average of 65 bu. of wheat per acre with a peak of 100 bu./acre (at least twice) was obtained, not using any outside fertilizer but only the farmyard manure, properly composted. On another field, yields of 135 bu. of oats per acre were obtained. These oats grew three years after the last application of manure, without any other fertilizer, on moderately fertile soils. But the biological and organic conditions of these fields were properly maintained.

As soon as we deal with soils where the water table cannot be maintained on a high and steady level, soils which are on a slope or are exposed to drought as well as to excessive rains,

the water absorption and holding capacity of humus plays the decisive role. During drought periods, no nutrient solution exists, but roots can still draw from hidden moisture absorbed by humus. There the hydroponic concept does not apply. Only soil building practices, promoting the building up of humus from organic matter, proper aeration, the increase and balancing of soil life, that is, the control and feeding of the microflora, will solve the problem.

The efficiency of fertilizer application is another interesting problem. Not all the fertilizer applied is recovered in the plant crop. We have evidence of crops to which 200 lbs. of nitrogen were applied, but the actual uptake and removal of nitrogen was only 68 lbs. — a rather wasteful or inefficient use of nitrogen, it seems. Likewise, of all the phosphate applied, only 2% to 10% showed up in plants, the balance being locked up, tied down or otherwise lost. Because of the inability of roots to utilize these fertilizers, in many cases mineral elements which last for many years have also been built up in the soil. If the soil life is increased, these elements are returned or mobilized again. It is also possible that accumulations can reach toxic levels.

Humus management avoids these dangers and brings about a more efficient utilization of natural resources and fertilizers. The basic idea is to feed the soil life and this, in turn, will feed the plants. The organic acids and enzymes produced by living cells in the soil will increase the availability of minerals and counteract tying down. Carbon dioxide produced by microorganisms will feed the plants, producing the basic material for assimilation. The concentration of carbon dioxide in the soil is much greater than in the open air. Especially can low-growing plants in a closed, protected environment, where the wind does not blow away the carbon dioxide, profit from the soil's activity.

These are advantages which the hydroponic solution cannot offer. The humus in the soil acts as a buffer against pH excesses (extremes of acidity or alkalinity), and as a storage for moisture. A soil which analyzes 2% organic matter contains 40,000 lbs. of it per acre. The point is that this organic matter must be present as humus, not as crude straw, roots, leaves or offal, and must be changed into stable organic matter by a proper microbial process. Then it can absorb and hold the equivalent of its own weight in water. This water, in turn,

holds the nutrient soil solution, securing a slow but steady release of nutrients. This humus acts as storage and holds a reserve. A more balanced supply is provided and the "explosion" of leaves or fruit, that is, sudden and lush growth, is avoided. Humus management provides for a more efficient use of the soil. With it, a plant does not accumulate excessive amounts of water, which is otherwise needed in order to maintain the equilibrium of salts within the living tissue. Watery leaves do not keep well.

They collapse or wilt easily upon transportation or storage. A firm tissue stands up better and freezes better. Also, the processor of dehydrated vegetables and fruit knows very well that watery products require more heat for dehydration; in fact, 20% to 25% more than produce grown on balanced humus soils.

Watery fruit can become quite a headache. Tomatoes hit by rain just before harvest time tend to burst and may become a complete loss. In the citrus industry, one criterion of quality is the content of solids. Similarly, the potato chip industry, prefers potatoes with a high specific gravity.

Contrary to general belief, not the plant which has been *pushed* to grow has the highest and most diversified mineral content, but the plant grown slowly yet steadily in a humus soil. On one of our bio-dynamic farms, the wheat grown showed one of the highest contents of minerals and trace minerals and the greatest variety of trace minerals, even though this field had not received any commercial fertilizers for many years. We have a letter from a grain mill congratulating us on this result and asking about our fertilizer formula. When we told them it was done without any fertilizer but with compost, we never heard from them again. The point is that a more developed root system in a humus soil enables the plants to build up better texture, structure, flavor and aromatic substances. Wherever quality plays a role, humus soil will offer an advantage.

The conversion from the nutrient solution (= hydroponic soils) to humus soils is not too difficult. Many farmers and growers are timid about risking such a conversion, being afraid of losses in yield. In such cases, we simply proceed by introducing as much organic matter — organic fertilizers, composts and/or manures — as is needed to build up the humus content, and reducing the NPK dosage by the amounts contained in the organic fertilizer. The second step is to find the proper balance between all requirements. Where organic matter is plen-

tiful or organic supplements are cheap, it is possible to get along well without mineral supplementation, provided we are not dealing with soils which contain such a minimum of mineral matter that correction is an absolute necessity. Such soils are muck soils and peat, which run as high as 90% organic matter (on dry base), but this organic matter is not humus. Other such soils are pure clays (loam) or pure sand. Here the building up of a granular, agglutinated structure by way of a well-balanced humus compost with adequate microlife is a prerequisite to enable these soils to hold mineral nutrients and make them available instead of tying them down.

Clay soils on top of limestone, only a foot or two removed from it, have been found to be deficient in calcium (lime). This we ourselves witnessed in the Downs of southern England and in the Jurassic Mountains in Switzerland. It would be nonsensical and wasteful to add lime, but the introduction of humus management has usually solved the problem of such soils in which the integration of top and subsoil was interrupted.

It has been our experience that the NPK nutrients in compost manufactured with the B.D. Compost Starter last considerably longer and are more efficiently used than those applied in their mineral form. One problem we do not have on biodynamic farms is the nitrogen problem. The natural supply of nitrogen by way of treated manures and composts stimulates nitrogen fixation in the soil. Maybe 20 to 60 lbs. of nitrogen are applied per acre by way of organic fertilizer. But the soil life itself produces, assimilates and stores at least the same, if not double the amount, in addition. The release of this organic nitrogen is slower but is steady throughout the growing season. The release of ammonia from mineral fertilizers is quick but not lasting, that is, it is a rather wasteful process.

A humus soil contains protein from bacteria bodies and algae, and amino acids from the breakdown of said bodies. Humates and humic acids are end products of the soil metabolism. Uronides affect the agglutination and cause a crumbly, friable structure. It is regrettable that academic soil microbiology by-passed much of this and so concentrated in its research on the humic acids of forest soils that a wrong concept prevailed for several decades, until finally the complex process of humus formation was, so to speak, re-discovered. The textbooks written by some of the great masters of soil microbiology so many years ago are almost forgotten, but they still contain the

most modern information in great accord with the actual facts.

We think here especially of two authorities who worked for the Department of Agriculture after World War I and at the University of Wisconsin: F. Loehnis and E. B. Fred[1]. One of them, Loehnis, had already published a textbook on the subject in 1913[2]. This is still one of the most elaborate and complete sources of information today. Another man, S. Winogradsky, spent a lifetime working on the problem of nitrogen fixation[3]. Waksman[4] also published much important information, although maybe he dwelt a bit too one-sidedly on the humic acid and humate concept. Much has been said in many of these textbooks [5] [6] and in others about humus and organic matter. The subject, therefore, is not entirely unknown. It is only that, because of the simplicity of the mineral concept and the complexity of the biological concept, most researchers and practitioners were distracted.

The basic idea of the permanent fertility of humus soils was already outlined in a Russian publication in 1911. This explained that the Ukrainian soils which produced wheat crops for 80 continuous years without decline, showed a high microflora content of azotobacter and actinomycetes. It was also stated there that humus formation was maintained best under aerobic conditions when evaporation and precipitation, as well as absorption of water, were kept in balance.

The originator of the bio-dynamic method, Rudolf Steiner (cf. BIO-DYNAMICS No. 40, Spring 1956 — "Rudolf Steiner's Impulse to Agriculture" by E. E. Pfeiffer) pointed to the quality problem of agricultural production, to resistance to diseases and decline, especially when only quantity yield was forced, already in 1922-1924.

Sir Albert Howard[7] outlined the importance of organic matter and reported successful practices in India. Recently, William A. Albrecht of the Missouri University Dept. of Soils has published numerous papers and books on the subject "organic matter in soils" [8]. The fundamental concept, "feed the soil and the soil will feed the plant"[9] is still in need of recognition. A summary of the problems involved is contained in "Health from the Soil" by Arnold Vries[10].

If as much time, money, research and effort had been spent on furthering the organic concept, the basis of which was laid by the above-mentioned, as has been spent on the NPK concept, we might have an entirely different type of agriculture today,

probably free from the curse of chemical sprays and toxic residues.

An important paper has recently been published by Donald Lewis Mader[11] as a thesis (Ph. D. in soils) submitted at the University of Wisconsin. Mader studied the effect of biocides (poisoning insecticides) upon soils and the growth of forest tree seedlings. We quote: "Toxic effects of the high rate of biocides applied to the soil were expressed in reduced survival, unbalanced uptake of nutrients and retarded growth of tops and roots . . . Application of fertilizers to biocide-treated soils greatly increase the toxicity, in some instances killing the entire stock. Incorporating of certain types of solid humus material, especially in soils containing both biocides and fertilizers, decreased mortality . . . Biologically active forms of humus carrying a high supply of energy material and nutrients and possessing high exchange capacity were the most beneficial."

In still unpublished research but partially reported at the B. D. Conference this summer, this writer, too, pointed out that B. D. Compost Starter-treated compost added to test soils in closed containers inhibited the uptake of DDT by corn and lettuce and eventually broke down the DDT in such soils.

Nowadays, detoxification is one of the most important problems. Detoxification, resistance or immunity in organisms are brought about by enzymes. Enzymes, too, are active agents in the metabolism of a soil and its microlife. The future of healthy agriculture and healthy soils depends upon progressive research in the direction of enzyme reactions in soils. We repeat: If as much effort is spent on these problems as has been spent on NPK, we may look forward to a prosperous future.

Basically, progress rests on the concept of looking upon nature, upon the relationship between soil and plant (crop) as an integrated whole, as a concerted interaction of *all* factors of growth. One separate item, such as NPK, exclusively promoted, will make the whole system suffer. The yield will increase, because of forced feeding, at the expense of structure, quality, defense, lack of detoxification, etc. The experience of another branch of biological science should serve as a great warning, namely, that immunities do not build up in tissue cultures but only in *the whole of a complete organism.* To "harvest what we have sown" contains a great truth. Insect pests, diseases, degeneration or loss of vitality, loss of quality and resistance also are a "harvest."

BIBLIOGRAPHY:

1. **Loehnis, F. and Fred, E. B.:** Textbook of Agricultural Bacteriology. McGraw-Hill Book Co., N. Y., 1923.
2. **Loehnis F.:** Vorlesungen ueber landwirtschaftliche Bakteriologie, 1913. Handbuch der landwirtschaftliche Bakteriologie. Borntraeger, Berlin 1910 u. 1938.
3. **Winogradsky, S.:** Microbiologie Du Sol. Massonet Ac. Paris 1949.
4. **Waksman, S. A.:** *Soil Microbiology. John Wiley and Sons, N. Y. 1952. **Waksman, S. A. and Starkey, R. L.:** The Soil and the Microbe. John Wiley and Sons, N. Y. 1931.
5. **Bear, Firman E.:** Chemistry of the Soil. Reinhold Publ. Co., N. Y. 1955. Soils and Fertilizers, John Wiley and Sons, N. Y. 1949, 3rd edition.
6. Agricultural Chemistry. A Reference Text. D. E. H. Frear, editor. 1. Vol. XXIV. Soil Organic Matter. J. E. Dawson, D. van Nostrand, N. Y. 1930.
7. **Howard, Albert and Yeshwand, D. Wad:** The Waste Products of Agriculture; Their Utilization as Humus. Oxford Univ. Press, London 1931. **Howard, Sir Albert:** An Agricultural Testament.
8. **Albrecht, Wm. A.:** Quality as Feed, Not Only Quality as Crop, Demonstrates Effects of Soil Fertility. Nat. Food and Farming, Vol. 2, No. 9, Dec. 1955. Diagnoses or Post-Mortems. Ibid. Vol. 6, No. 4, Sept. 1959.
9. **Wynd, F. Lyle;** Feed the Soil. The Scientific Monthly. Vol. LXXIV, No. 4, 1952.
10. **De Vries, Arnold:** Health from the Soil. Chandler Book Co., Chicago, Ill. 1958.
11. **Mader, Donald Lewis:** Effect of Humus of Different Origin in Moderating the Toxicity of Biocides. The Soil and Health Foundation, Emmaus, Pa. 1960.

LETTER FROM MOSCOW

ERNEST F. WINTER

The editors of Bio-Dynamics take pleasure in presenting this report of observations and impressions on the state of organic agriculture in Europe and behind the Iron Curtain. Our good friend and contributor, Professor Winter, has been lecturing last Summer at an international gathering of experts at Strasbourg, and later traveled in Europe and in Soviet Russia. From there he wrote us, expressing regret at delay in getting his earlier Spring Valley lecture on "Ecology" ready for publication. If everybody who was late with a promised article came up with letters like this, getting out the magazine would become, as the younger generation sometimes says, "a ball".

* * *

Moscow, 8/10/1960

..... I hope you understand that it has been humanly impossible to put the finishing touches on my talk on *Ecology*. Yet I hope that you and the readers of B.D. may be interested to hear of some of my impressions over here. On July 10 I flew to Paris and participated in a series of lectures and seminars entitled "Hunger in the World", held in Strasbourg. These were sponsored by an international association — establishing a World University. The meetings were held at the Chateau de Pourtales; research was done at the University of Strasbourg; field trips were taken into surrounding regions.

The 70 professors and graduate students came from all over the world. All academic disciplines contributed their share. Thus the complex problem of hunger was seen from many approaches and I was able to present for the first time, "organics" at an international forum. Despite an overwhelming chemistic approach, most everyone had an open mind towards "organics". The time is fast approaching when "scientific organics" will be consulted. Dr. Pfeiffer's work is already being recognized.

In my lectures on Ecology I presented the view of a social scientist who is above all concerned with MAN and his LIFE. As such I gather data and investigate phenomena, only to learn that the life of scientific man, who sees everything in materialistic terms, has been producing stupendous threats to life, health and survival. From soil management to national health, the social critique of the social scientist discovers alarming facts. After a realistic appraisal of such phenomena, I suggested that the principles of *Ecology* hold a most important key for shaping a better future. The problem of hunger in the world also submits well to ecological treatment.

One of the most scientific applications of ecological principles is to be found in the scientific biological approach to agriculture and nutrition, as for example espoused by *bio-dynamics*. The work of Dr. Pfeiffer, especially his chromatograms, impressed everyone, as did a field trip to the "Telhof" near Heidenheim, Germany, since 1929 bio-dynamically managed. Despite its marginal environmental conditions (poor soil, frosts even in July, etc.) it places third in quantity production in the region, not to speak of the quality of its products.

The Director General of FAO, the Indian Dr. Sen, spoke of the necessity to maintain an agricultural economy in underdeveloped areas, rather than to look to industrialization as a cure-all. The vast mass of peasants is to be given a purposeful and productive life. Here again the ecological approach and especially the work of the various organic agriculturalists appears as a new and most helpful answer. The representatives of African and Asian lands were particularly interested in my presentation of applied ecology, that is scientific organics. The rigorously scientific work of Dr. Pfeiffer impressed many. In Asia and Africa, I believe, lies a new frontier for scientific organics! The practical answers of this approach to world-shaking problems will increase in effectiveness. But this airing of the work at a world forum brings also a great challenge. It is

our responsibility in the organic movement to practice most rigorously and to deepen our knowledge of ecology.

After my last seminar meeting on August 21st, I left on a 2,000 mile motor trip through parts of Europe, visiting farms, agricultural experiment stations and organicists. Everywhere I gathered the same impression: there exists a caution towards a chemistic approach to life and a desire to widen a scientifically-grounded biological approach. Pests, insects, diseases, economic and social problems are sapping the strength of continental agriculture. The inclination to seek a cure-all in further massive applications of fertilizers, insecticides, pesticides, hormones, isotopes, agricultural credits, migratory labor and the like is being seriously re-examined. Theoreticians and practitioners are becoming very cautious. Interest in biological control, biological soil science, the role of enzymes and the like is on the increase. I met no longer the "chemistic" enthusiasts of 1952. Everywhere I suggested a re-examination and propagation of ecological laws as the sine qua non of the "new wisdom". The problem subsequently becomes *how* to apply these scientific principles *now*. I stressed the need for a *new* approach, rigorously scientific, to the land and to life. The pioneering work of B.D. and other organicists has made it abundantly clear that the coming agriculture of quality plus quantity, by working consciously within ecological concepts, has no antecedents. Ours is not a question of restoring the peasantry and peasant insights, for example, but to practice new, scientifically obtained knowledge of the life sciences.

I have been pleasantly surprised to find here among Soviet agronomists similar arguments between the "chemistic" and "organic" approach. The evidences that leading agronomists are realizing the importance of ecological principles are heartening: from reforestation to biological insect control. Nutritionists tell me of the quality advantages of organically grown foods. Visiting suburban homes and "dashas" in the country I was thrilled to see what enthusiastic gardeners the people are. The private plots of the peasants are also utilized to the last inch. And everywhere one sees traditional compost piles. Since the landowning structure is such that it encourages intensive utilization of small private plots, organics would appear to have a chance among most people living on the land. How scientific this composting is and to what extent it is being practiced on the mammoth collective farms is another problem. The Russian

landscape is extraordinarily peaceful and fertile. But observation and conversation, here too, underlines the coming widespread application of scientific organic gardening and farming.

These are just a few brief impressions which I hope will encourage all of us to double our efforts at applied ecology.

VEGETABLES THAT SHOULD BE BETTER KNOWN

EVELYN SPEIDEN GREGG

From a lecture at the 1960 B.D. Conference.

The plant "classification" of botanists sounds to most of us like a Latinized realm far too complicated for comprehension, especially if we have ever tried to locate in it some lovely wild flower whose name we longed to know. Bio-Dynamic gardeners "classify" vegetables according to their position in the crop rotation: the heavy feeders (manure-loving) including cabbages, other leafy vegetables, melons, squash, cucumbers, corn and others; the light feeders (compost-loving) including bulbs, roots and aromatic herbs; and the soil benefactors in the legume family, peas and beans of many kinds.

When we bring these plants into the kitchen to use for food, still another "classification" takes over. Looking at the plant form, it is easy to see that there are three main divisions, — root, foliage and flower-fruit. Comparing the plant with man, we might say that a plant is like a human being standing on his head. The upper part of the plant shows the reproductive system, the stem and foliage provide for the rhythmic flow of sap as compared with the circulation of air and blood in the human lungs and heart, and the roots have many tiny "mouths" by which the plant sucks up moisture and food from its surrounding soil. We might say that the same forces are at work in the plant root as in the human head, in the plant flower and fruit as in the abdominal region of man, and in the plant foliage as in man's chest region. So carrots, beets, turnips and other roots provide special stimulation to man's head; cabbage, spinach, salad greens, chard and such leafy parts of plants, stimulate the rhythmic system of man's heart and lungs; his abdominal region benefits especially from such vegetables as cauliflower, broccoli, beans, peas, tomatoes, peppers and other fruits.

There are some of the lesser known vegetables in all three of these groups. Generally we do not think of broccoli and cauliflower as blossoms, so what was our surprise at one of the festive

dinners at Fetzer's during a Farm Conference, to see great purple heads of cauliflower as table decorations. The purple turns to green when the heads are cooked, yet they still have the cauliflower flavor. The growth and cultivation is the same as broccoli and when the center head is cut, smaller heads form on side shoots. It is easier to grow than white cauliflower, — no blanching, and quicker growth.

Easier to remember than "okra", is its Indian name "lady fingers." As one would expect, a plant common in India, needs warm weather. Given a good start, it produces prolifically, so that one must pick the pods daily when 2 to 3 inches long. Larger than that they are too tough to eat whole, but the seeds are good alone. It is excellent for freezing too.

Red peppers are not necessarily hot peppers, as most people seem to think. The "hot" ones are different varieties and are just as hot when green as later. But the sweet, bull or pimento peppers which we generally use green, are much better when allowed to ripen. Their vivid red adds color to many a dish, their vitamin C content is doubled, they are sweeter and more easily digested. But it takes more time to get red ones, probably one reason we seldom see them grown commercially. One must start seeds indoors in the northern half of the United States, giving them two months of growth before the time of last frosts when they can be set out. Indoors transplant at least once, from the seed bed to a three inch apart spacing. On the second move, to the garden row, set them 14 to 18 inches apart. To insure enough warmth for good germination, I have found it helpful to place the seed flat on a metal tray and set the whole above the gas stove pilot light at night. This works too for making bean sprouts. For freezing, peppers need no blanching and can be dumped whole and en masse into a large plastic bag if one has enough space for this in the freezer.

Tree and bush fruits belong in this third group, as well as tomatoes. In the tomato family is a small fruit called husk tomato, or poha, according to the Hawaiians who are fond of it. The round, yellow fruit usually just under ½ inch in diameter, is enclosed in a loose, lantern-shaped husk which turns from green to beige as the fruit ripens. It keeps well and tastes delicious raw but may be frozen or stewed. It does not remind one too much of a tomato, but has its own satisfactory individuality. There are several closely related plants,—the Cape Gooseberry of the tropics which is much larger but needs a longer

season than that of the northern U. S., and at least one smaller sort that grows wild but does not produce prolifically like the cultivated form. The husk tomato needs the same cultural care as the tomato,—and is worth it. It makes delicious preserves too.

Among legumes are several valuable additions to the food supply. "Snow peas", as the Chinese call the sugar peas which one eats pod and all, are listed in most seed catalogues. We like the Dwarf Grey Sugar and the Mammoth Melting Sugar. The latter is tall-growing and very productive, the former grows little over a foot high and two rows planted some six inches apart usually support each other with the help of a few sticks to resist wind. Planted just like ordinary peas, the trick is to get them picked in time. This must be after one sees the peas forming in the pod but before they swell much. If left until the peas are fully formed, they are too tough. Once started, they require almost daily harvesting. String them from both ends like string beans. Do not cook too long. Delicious with just butter and salt! Fine in soups and chop suey. You get more bulk and less work when it comes to freezing than with ordinary peas. Blanch briefly in steam and then cool in the refrigerator. Blanching and cooling in water takes too much out of the vegetable.

Broad or fava beans are "richer in protein than any other English vegetable", says Eleanor Rohde. For ages they have been used for food in the cooler regions of Europe and Asia, for although a bean, they are frost-hardy and must be planted in early spring along with peas. Their growth is distinctive,—several upright stems a foot or two high and carrying lovely lavender, black and white blossoms. The bean itself is immense, light brown, larger than a lima and with the "eye" at the end. Pod and all may be eaten when very young, later when still green but full size, they are good cooked in the pod and then squeezed out for eating. Or they may be shelled and dried when fully ripe. In this case some like them better with the skin removed after cooking.

Contrary to popular opinion it is the mung bean rather than the soy bean which the Chinese most commonly sprout. The mung bean is smaller than a pea and olive green, easily grown in the garden like other beans. In sprouting they absorb much water at first, swell and shed their green skins, leaving a creamy-white bean and sprout which we like when about ½ inch long.

Golden Acres Bio-Dynamic Seed Catalog 1961

Golden Acres Farm, Inc.
Newtown, Bucks County, Pa.

The need for bio-dynamic seed growing is obvious to anyone who is acquainted with the production of vegetable crops. This action is the first step towards realizing the idea and filling the need. The variety offered is still small, but will be enlarged over the years, depending largely upon the response of the home-gardener. It is suggested therefore, that an order includes a listing of additional seeds which a customer would buy. Our planning could be guided by such help and all efforts directed accordingly.

All seeds have been grown on our soils, composted for many years and brought to a high fertility. The plants were never sprayed or dusted with any of the commercially sold chemical insecticides or fungicides. We believe that the plant is naturally healthy and can be kept in such a state by proper methods of breeding, growing, fertilization, and cultivation. Bio-dynamic ideas govern the seed-growing and treatment.

The quality of the seed is checked by standard germination tests. In addition, the vitality factor is tested (Biochemical Research Laboratory, Threefold Farm, Spring Valley, N. Y.) by running a chromatogram for each seed. The method used is described in BIO-DYNAMICS #50 and #54.

The compost has been included in the seed list for a good reason. It accompanied the plants on the farm for many years; the seed owes its vitality and inner health to the compost. The best results will be achieved, therefore, and a high quality product will be produced, if the relationship between seed and compost is kept.

DESCRIPTION OF VARIETIES

CANTALOUPE—"BANANA." The name refers to the shape of this melon which resembles a huge banana. The flesh is deep yellow and has a delicious flavor. Many fruits grow to a size of 2 feet.

CANTALOUPE—"HARVEST QUEEN" has become a well-known variety for its shipping qualities. The rind protects itself against rotting through a coarse netting. The meat is the thickest we know of in a melon, very tasty and of dark orange color. The average weight of a melon is 3 - 5 lbs.

CUCUMBER—"CHINA." This cucumber forms long thin fruits, sometimes measuring 2 feet. It is the ideal salad cucumber because it has few seeds, but a very tender skin. Grown on a trellis, quality and uniformity are improved.

CUCUMBER—"GOLDEN ACRES" is our normal-type cucumber. It belongs in every home-garden for an all-year supply. Plants are vigorous and productive.

KALE—"SIBERIAN" is a fast growing variety for fall and winter crop. Plants are frost resistant and continue producing in spring. The leaves are curly and very tender, whether eaten raw or cooked.

PEPPER—"PENNWONDER" is a real success. The seeds germinate extremely fast and produce vigorous and healthy plants. Our harvest of green peppers starts already by the end of July. The fruits are three and four-lobed and have a very thick, sweet meat. They are tasty enough to be eaten like an apple, especially when they turn red.

SQUASH—"BUTTERNUT." Many people consider this variety the favorite among the winter squashes. It is a reliable yielder of fine quality fruit. The dry meat is sweet and deep yellow. The squash stores well during winter.

TOMATO—"VALIANT" is the seed we are most proud of. This strain has been completely re-vitalized and turned into an all-year bearer. It really produces, the earliest crop as well as the latest. The fruit is round, fine textured, delicious in flavor and became our all-purpose tomato. All our plants have been wire-trained.

TOMATO—"RUTGERS" is the well-known late variety for productiveness. It is about two weeks later than "Valiant" but produces after maturity an abundance of well-formed and well-colored tomatoes until the frost kills the vigorous vines. This variety is our choice for the field-grown crop.

WATERMELON—"NEW HAMPSHIRE MIDGET" is an early ice-box type. It always has been preferred for its sweetness and earliness.

WATERMELON—"RHODE ISLAND RED" is the early type among the standard-size watermelons. Fruits weigh between 8 and 20 lbs. and, when fully ripe, are saturated with juicy meat being sweet and dark red. The vines are vigorous and productive.

SUNFLOWER—"MAMMOTH RUSSIAN." This standard variety serves on our farm as a windbreak for many crops. It grows 10 feet high and, grown in rows, also retards weed growth. Moreover it is a good producer of bird seed.

EARTHWORM COMPOST. This is a compost which is composed of nothing more but earthworm castings. It is of alkaline nature and has a naturally well-balanced formula of plant-nutrients, including trace-minerals. We use the compost as part of a mixture for starting all vegetable plants. It is too rich to be used alone. Mixed with regular garden soil it makes the ideal earth for potting.

REGULAR COMPOST is the compost that we fertilize all our fields with. Any garden soil will become more fertile through regular application. The reaction also is alkaline. The compost supplies all necessary plant nutrients to the soil. It is produced with the use of B.D. Compost Starter. An application of 75 lbs. to 100 sq. ft. would equal our fertilization of 15 tons to the acre for heavy feeding crops.

B.D. COMPOST STARTER. Many home gardeners certainly make or want to start their own compost. Such active interest creates a deeper understanding of the growth process in nature. For a healthy development of this process we strongly recommend through long experience the use of the B.D. Compost Starter. It is a concentrated mixture of soil- and humus-forming organisms which guide and speed up the decomposition of all organic wastes. Instructions are included with each shipment.

INTRODUCTORY OFFER: 1 Pkg. Kale-seed FREE
with each 50 lb. bag compost ordered

VEGETABLE SEEDS — PRICE LIST 1961

Pkge.	Variety	Unit Price	Price
	Cantaloupe		
	"Banana"	$ .45 Pkg. (not less than 50 plants)	
	"Harvest Queen"	.35 " (" " " 50 ")	
	Cucumber		
	"China"	.50 " (" " " 50 ")	
	"Golden Acres"	.40 " (" " " 50 ")	
	Kale		
	"Siberian" $2.50 oz.	.30 " (" " " 200 ")	
	Pepper		
	"Pennwonder"	.35 " (" " " 100 ")	
	Squash		
	"Butternut"	.30 " (" " " 50 ")	
	Tomato		
	"Valiant," wire-trained	.50 " (" " " 100 ")	
	"Rutgers," field-grown	.40 " (" " " 100 ")	
	Watermelon		
	"New Hampshire Midget"	.40 " (" " " 50 ")	
	"Rhode Island Red"	.40 " (" " " 50 ")	
	Sunflower		
	"Mammoth Russian"	.40 " (" " " 100 ")	
	Earthworm Compost 10 Lbs.	2.50 prepaid	
	B.D. Compost Starter, 1 unit	1.65 prepaid (enough for 1 ton)	
	Regular Compost 50 Lbs.	2.10 express collect	

All seeds and earthworm compost are sent prepaid. Regular compost express collect. Please add 4% sales tax to the total amount if you live in Pennsylvania.

Total Price .....

Pa. Sales Tax 4% .....

$ .....

Suggestions for future seed growing:

NAME .....

ADDRESS .....

It is easy to float off the skins, though they may be eaten. The easiest way to sprout is with two earthenware flower pot saucers, using one for the cover. One must learn by experience how much to do at one time. We place a single layer of beans in the lower saucer, add lukewarm water to more than cover. Let stand overnight in a warm place or over the gas stove pilot light (with a metal dish between). Add water if it is all absorbed. In the morning pour off any excess water, rinse under the tap (lukewarm water) and keep moist thereafter but with no excess water. It usually takes about three days for the sprouts to get long enough to store in the refrigerator until needed. Mix in soups, salads, omelets, cereals, macaroni dishes or eat alone just warmed in butter. They are good raw, but if cooked they should be barely heated through.

Among the light feeders are two which need to be planted indoors in early spring along with peppers, not because they are tender, but they simply require a long growing season, — leeks and celeriac. Both do especially well if they can have composted pig manure. Both need two transplantings, one from the seed bed into the close-planted row, then later to their final place in the garden where celeriac plants should be 12 to 15 inches apart, leeks 8 to 12 inches. Both need the whole season to mature and will continue growth into the cool fall weather. Leeks may be left in the ground all winter, but if not used in early spring are liable to rot or to send up a seed stalk. They are milder than onions and are best served (the lower white and light green part) steamed and with butter and salt. In soup with potatoes they are delicious. If one makes vegetable broths the remaining green leaves of the leek are good material. The smaller, central green leaves may be cooked along with the white base. Celeriac, or root celery, forms at the ground line a knob like a small turnip from which celery-like leaves grow. Its culture is the same as celery except it needs no blanching. But it will not do well unless the soil is fairly rich and friable. The root may be shredded raw in salads or cut in small pieces, cooked a little and served alone. It is good in soups.

Jerusalem artichoke, a perennial root reminding one of the potato, may be used as a potato substitute, especially for diabetics. It is of the easiest culture, grows rampantly and can be kept in the ground until wanted. It has no relation or similarity to the globe artichoke. It may be steamed in the skins and the liquid remaining will jell, making a good soup. Some like it

baked; or sliced raw, dipped in batter and fried; or cooked, thinly sliced and served cold with mayonnaise.

In the group of leafy foods are a surprising number of little known plants, some with outstanding nutritional value. Mustard, in several varieties, is one of these. The young leaves are good raw in mixed salads. Older leaves have a strong flavor which some people like very much and others have to learn to like. Generally it is better to mix mustard greens with other mild-flavored leaves such as chard. A member of the cabbage family, mustard is very easy to grow. Sow early and thinly in the garden row where it is to stay. Do not transplant. It grows rapidly and should be used before the hot weather. Sometimes successive, small sowings all summer will do well, in wet or cool seasons. To avoid the flea beetle, keep the soil shaded by mulch or cultivation. Mustard freezes well and small amounts can be added to packages of other greens.

Collards and turnip greens are strong-growing, non-heading members of the cabbage family common in the south where they can grow all winter.

Of all the heading cabbages, the savoy and the red are the most worth growing. Both are late maturing and need the whole season for growth. The savoy has a finer flavor than any other cabbage. The red cabbage is good shredded and cooked with just a little water, some diced, tart apples, a dash of nutmeg and a little honey and lemon juice. Add salt at the end of about 12 to 15 minutes cooking.

Some common weeds especially good to eat are the pokeweed, lamb's quarter, amaranth or red root, dandelion and stinging nettle. The latter contains more iron than any other plant. Cooked briefly like spinach, its sting disappears. Pick two or three pairs of tip leaves when the plant is four to six inches high in spring. You'll like it! Pokeweed also has the advantage of being a perennial, so if you once locate a few plants, you can cut the shoots each spring when four to six inches high, or until the flower buds appear. Some directions say to cook in several waters, but I have not found this necessary and it would certainly be wasteful of vitamins and trace minerals. The shoots can also be parboiled (or steamed), rolled in cracker crumbs or cornmeal and fried. The large root is poisonous to eat, but it can be dug up in fall and brought indoors to produce shoots all winter. Dandelion roots may be treated in the same way, except that they need protection from light to produce blanched leaves similar to the Witloof chicory. The very young dande-

lion leaves in spring, although a great bother to wash, are delicious for salad, especially because they come so early. When they grow a little larger, they are good for cooked greens, but only until the flower buds appear.

Lamb's quarter (chenopodium album) and green amaranth or redroot (Amaranthus retroflexus) are both sometimes called pigweed, but they are quite different, though both are plants common to cultivated areas. These two will grow several feet high in the course of the summer, but they are good to eat only when a few inches high, before flower buds appear. In spring one can quickly find a quantity of either, but throughout the season young plants continue to appear. Both mix well with other greens and both are excellent for freezing.

Witloof chicory (also called French endive) is now fairly common in our markets. In Europe it is a staple winter salad. However, it gets bitter soon after being cut, so is not especially good for eating raw unless it can be raised at home. This is easy to do. In catalogues seeds are usually listed as Witloof chicory. Sow them in the garden row early in spring and be *sure* to *thin* the plants to three inches or more apart as it is the root development from which we get the winter crop. It does not transplant well. Just let it grow all summer. Pull out any plants which shoot up a seed stalk. In fall after a few frosts, cut off the top just *above* the crown, dig up the roots and set them close together in boxes or buckets with crowns at the same level at the top. Be sure there are bottom holes for drainage. Fill in around the roots with sand. Water well once to settle the sand, then keep barely moist. Too much water will cause them to rot, but neither must they dry out. Freezing does them no harm, so you can leave them outside until wanted, bringing in a few at a time to force. A temperature of 50 to 60 degrees is best and the most important thing is to have them in a completely dark place or cover the container with a foot of leaves so that the growing shoots will get no light. They are ready to cut when about four inches high and will grow again several times. Do not cut until you are ready to use them, as the flavor soon changes. Wash quickly and chill. For salad cut into half inch lengths. For cooking use whole.

You are probably thinking now of other plants not mentioned. True there are many more that could be added. These are only some with which I have had experience. Notes of your experiences with other plants not included here, would be welcomed.

CLIMATE AND GEOGRAPHY

GEORGE CRAGIN

We are told by geological investigation that at times the climate over the earth as a whole has been quite uniform. These were times when the sea covered more of the earth's surface than it does today, and what land did exist was low and swampy. A warm tropical climate extended even to the polar regions. Then there were other periods when great mountain ranges were thrust up, land masses capped with ice thousands of feet thick, and jungle conditions have existed along with extreme desert conditions. Such a period we seem to be in at present. The greatest ice age is over and glaciers and ice-caps are still shrinking. Glaciers all over the world have retreated hundreds of feet up their valleys in the last hundred years. This would seem due to a general warming trend, and also a drying-up one. The Great Salt Lake has likewise shrunk, and two considerable lakes in semi-desert eastern Oregon, Harney and Malheur Lakes, have all but disappeared from the map. But there is no sign that the climate of the eastern United States is getting any drier, though it may be a bit warmer, at least in the summers. It is in the West, however, that extremes of topography bring about extremes of climate, so let us examine a particular region, the contrast between the western and eastern parts of Washington and Oregon.

We can start our journey at Portland, Oregon, situated on the Willamette River, close to its confluence with the Columbia; in a well watered and fertile region, yet close to preserves of gigantic Douglas fir and cedar trees. No one who has only seen our relatively open and almost arid eastern hardwood forests can fail to be impressed by the solemn gloom of these tremendous trees. Here there are no dry leaves nor crackling underbrush under foot, but instead a thick carpet of moss covers the ground as well as the lower trunks and branches of the trees. Ferns are abundant, and one's progress is blocked by enormous vines. The whole resembles nothing so much as a temperate zone jungle. And it is really temperate, as the air is always cool and damp. It is as if one were underground in a cavern of green stalactites and stalagmites. Very often the whole forest drips, especially in winter when the long rains come.

Our route to the east takes us through the Columbia River Gorge, a remarkable cleft through the high plateau of the Cas-

cade Mountains. These mountains rise abruptly a few miles to the east of Portland and continue for a hundred miles or so until they gradually die out in the Columbia River Basin of eastern Washington and Oregon. The plateau in the vicinity of the gorge has a general elevation of 6,000 feet, but it is so cut up into a wave-like succession of ridges and valleys that the plateau is only evident if one climbs to the crest of a ridge and sees that it stands at the same elevation as all the others. The valleys are all deep and clothed in the dense forest described above. In the gorge there is a good mixing of deciduous trees with the evergreens, and the walls of the gorge are hung in many places with spectacular waterfalls which drop in slender veils for several hundred feet, particularly on the Oregon side of the river, sloping north and therefore more moist.

But as we proceed eastward we notice a gradual thinning out of the vegetation; this is evident at Hood River, 60 miles east of Portland. Moss and underbrush become less frequent, and in place of firs and cedars pines and oaks now appear. The ponderosa pine is the typical forest tree of the drier eastern slopes of the mountains, with its orange scaly bark and more open branches. They are also giants, sometimes rising to a height of 200 feet. The whole aspect of the forest is now more open, dry and aromatic. One can find no pleasanter camping place than in a grove of these attractive trees, and to wake up with the morning breeze sighing in their summits is a pleasure indeed. Usually the cloud canopy that we had over us at the western end of the gorge begins to break up now and the sun picks out yellowish patches of dried grass growing on the gentler slopes of the canyon. A hundred miles from Portland the last trees give out and we enter a region of steppe or semi-desert conditions where the rainfall averages less than twenty inches a year. And this in contrast to the western slopes of the mountains which have an average rainfall of more than 80 inches in places. The mountains are so high that the moisture-laden winds from the Pacific spend themselves on the western slopes and are wrung dry by the time they are over the barrier. Meteorologists speak of this as a rain-shadow. We have to leave the continental United States to find a more spectacular rain-shadow, but the island of Oahu in the Hawaiian Islands has it. There jungle and desert conditions arise on opposite sides of a single mountain range due to the prevalent north-east trade winds. With the mountains now behind us we follow the

greenish glacier-fed Columbia across tawny sun-baked plains dotted with clumps of sagebrush. The transition is now complete. In the course of a hundred miles we have passed from temperate rain-forest to desert.

Anyone who has lived on or near the south shores of Lake Erie or Ontario in winter is familiar with the extended spells of overcast weather often lasting for weeks, when it is either snowing or about to snow. The icy winds from Canada crossing these relatively warmer bodies of water generate a low cloud layer. Going southwards the winds then meet the gradual rise of the Allegheny Plateau where they are again chilled, with a consequent precipitation of snow on the hills. This region can be guaranteed a heavy cover of snow all winter as long as the winds blow from the northwest, as they usually do. But now a peculiar thing happens. Crossing the plateau the winds now descend to the lowlands of the Hudson Valley, northern New Jersey, and eastern Pennsylvania. Somewhat warmed by their descent, the clouds disappear and likewise the snow. It is only through other less dependable conditions such as passing storms, that we who live closer to the Atlantic coast get our snows.

If we look at weather conditions over the earth we are struck by certain similarities as well as differences. Eastern Asia and eastern North America have many points in common. Both have hot, humid summers and generally dry cold winters. This is due to the prevailing winds which in summer blow onshore from the oceans and in the winter blow offshore, from the frigid wastes of northern Canada and Siberia. Peiping, China has a more extreme climate than any of our mid-western or eastern cities. Imagine a city as hot and humid as Washington, D. C. in the summer, mean temperature 80 degrees in July; and as cold as Portland, Maine in the winter, January mean temperature 22 degrees. Instead of a vast fertile river basin such as we have in the Mississippi Valley the plateaus and deserts of Asia crowd in upon the east coast. It is as though Montana and Wyoming were at the back-door of New York City, beginning around Buffalo.

On the European side of Asia, however, matters are quite different. Instead of mountain ranges running north-south and parallel to the coast interspersed with arid basins as in North America, we have a tremendously indented coastline with ranges and isolated mountain masses running east and west. These offer very little barrier to the prevailing moisture-laden

winds from the Atlantic and the whole continent is surrounded and interpenetrated by arms of the sea. Thus the area as a whole has sufficient to abundant rainfall and supports a large population. Extremes of climate such as we have described in our western states are unknown, except for the arid plateaus of Aragon and Castile in Spain, one would have to travel all the way to the Near East or to North Africa to find a true desert.

It is interesting to observe these conditions as they are now because we stand on the threshold of an era when man with his new and unlimited sources of power will undoubtedly modify large areas of the earth's surface. Plans have been afoot for many years to flood the Sahara Desert, restoring a fertility which it once had during the Ice Age but has been losing ever since. The outcome of this, whether the earth will be made a garden (which was the original intention) or more of a desert than it is now depends entirely on man's 'inner climate', over which only he has control.

GOLDEN ACRES CONFERENCE REPORT IN NEXT NUMBER

A report on the 1960 Farmers' Conference held at Golden Acres Farm, Newtown, Bucks County, Pa., in October, will appear in the next issue. There will also be an article by Heinz Grotzke of Golden Acres, on "The Root in Its Environment", based on a lecture he gave on this subject at the Farmers' Conference.

SOME RANDOM NOTES ON BIOLOGICAL CONTROL

PETER ESCHER

The farmer and the forester today are plagued by insects and diseases. These infestations seem to be growing; some may disappear, while other and more virulent ones suddenly occur. The yearly estimated damage due to plant diseases is three billion dollars, according to the Department of Agriculture Yearbook of 1953. The estimated annual damage due to insects at that time was given as some four billions. And there is little or no indication that the ravages of insects and plant diseases have decreased. Quite to the contrary. Mass spraying of entire regions has been introduced. When a boat has been sinking and a bigger pump is needed to keep it afloat, it can safely be assumed that the leak has not been plugged.

The current thinking is, to use sprays that eradicate all the

insects damaging a certain crop. The operator can then breathe more easily, with the feeling that the problem has been solved.

Some of these materials are toxic and require very careful handling. If this is not done the operator risks being temporarily or permanently incapacitated, if not worse. The user's aspect of the matter has not been gone into by many people. The residue from poisonous sprays, affects, however, not only the plant and the fruit but also the soil.

A new science is gradually coming to the fore, called Biological Control. While it may not necessarily be the answer to the entire problem, it is certainly an important weapon.

The Japanese Beetle is combatted today with the help of a "milky disease." It is sold under the trade name "Doom" in many stores. Several predators of the wasp family had previously been introduced. They were not sufficiently effective. In 1933 the milky disease, a bacterial infestation, was discovered in New Jersey. It lives in temperatures from 61° to 97° F. It is most effective at a soil temperature of 70° F. The spores in a dry state keep for a number of years. They also retain their effectiveness in the soil for several years. The spores can be applied with a corn planter, or mixed with fertilizer. The amount needed depends on the infestation.

The Japanese Beetle eggs are laid in Summer. The grub stage starts in Mid-Summer. The beetle in its adult form comes out the next year. If Japanese Beetle grubs are observed when tilling the soil in Fall, it is advisable to infect it then with the milky disease. The rate of application can be 3-10 feet apart, or by covering one tenth of the area, or by spreading the disease more or less thinly over a larger space, depending on the spread of the grubs. This disease has also been found in the grubs of June beetles.

Bacillus thuringensis has been tried with good results. It does not, however, appear to be a stable bacteria and its effect was not lasting.

Fungus diseases develop when the relative humidity is high, whereas many of our insect infestations occur in dry and warm weather.

Some experiments have been made with a wilt attacking the Gypsy Moth. More tests are needed to bring them to fruition.

The resistance of insects to virus diseases depends upon the general well-being of these damaging insects. It might be a

good idea to stop creating a favorable habitat for these pests that are so injurious to our crops.

The trouble in this connection is that nowadays the farmer figures essentially in terms of having a given area of land available, on which, in order to make ends meet, he has to grow a certain amount of cash crops. This method of figuring is quite correct from an immediate economic point of view. The result of this calculation may lead him to one crop, or predominantly one crop. We are living in an age of specialization. Many successful growers know only how to grow one crop. If they cannot grow it in one place, they prefer to migrate somewhere else, rather than remaining on their farm and growing a different crop. These specialists have learned to grow that one crop, and indeed do know a lot about it.

However, if monoculture is practiced, the care required to maintain a biological balance is much greater, and indeed the equilibrium is tenuous. Take the example of grape growing in Europe. There are relatively few localities where grapes do well. Hence the value of that land is higher. It is interesting that grapes were one of the first crops, if not the first, to which poisonous sprays were applied to maintain the yield.

In the Bordeaux region of Southern France they grow some of the preferred grapes for wine today. In the spaces between the grapes, alfalfa is grown, which seems to benefit the grapes. Now in France too there is a serious labor problem these days. In order to simplify the handling, and increase the accessibility of the vines, they have taken out one row of grapes and have grown the next two rows closer together. The next row was again taken out and alfalfa planted in its place. This has permitted the achievement of a better balance between alfalfa and grape, while simplifying the handling. It is to be noted that the yield has not decreased. The grape happens to be a heavy feeder. Its yield can be increased by judicious handling.

A good many of the predators useful to farmers for biological control are of the wasp family. They lay their eggs in a host insect. If this insect is an economic pest, its ravages can be contained by the predator's efforts. But as long as the particular pest does not do much harm, we take little or no notice of it. If its damage starts to be noticeable, the grower gets the idea that it has to be eradicated completely. Highly toxic sprays are used to do the job. If the Food and Drug Administration does not accept the spray, the next step is getting to be "write to your Congressman."

With this outlook toward spraying, the beetles are indeed killed. So are the predators. Now it so happens that one predator can do away with many hosts. The predators often use only one insect to lay their eggs in. They are slower than many other insects in becoming acclimatized to a place and propagating. So by killing all the insects, one thing is achieved: that is, to set the predators back more than the damaging insect. The result is that next time more stringent methods have to be used.

Pest control treatment of avocados in California is seldom necessary, according to Charles A. Fleschner of the University of California's Citrus Experiment Station at Riverside. "Each year only a fraction of one per cent of the total avocado acreage receives chemical pest control", he states in an article reprinted from *Biological and Chemical Control of Plant and Animal Pests*, published and copyrighted, 1960, by the American Association for the Advancement of Science, Washington, D. C.

"Field studies now in progress have shown that despite seeming freedom from destructive pests, there are many insect and mite pests of potential economic importance present in avocado orchards throughout Southern California, but that in general they are under almost perfect biological balance. Some of the potential pests, such as the long-tailed mealybug, *Pseudococcus adonicum* (L.); black scale, *Saissetia oleae* (Bern.); and soft (brown) scale, *Coccus hesperidum* (L.), are controlled by introduced parasites, but most of them are controlled by native parasites and predators. Numerous experiments have shown that, in any area, when parasites and predators are excluded from avocado trees, damaging populations of various mite and insect pests soon develop."

Mr. Fleschner also states in his article, which has been reprinted as a pamphlet, that, "In order to test the effect of certain insecticides and acaricides (mite killers) on the biological balance in avocado orchards, two long-term experimental blocks were set up in previously untreated avocado orchards. . . .

"At the time these experiments were started, no insecticidal treatments had ever been applied to either of the avocado orchards and no pest had ever developed to economic proportions; a very low population of latania scale occurred throughout the orchards; occasional colonies of avocado brown mites could be found on dusty trees near a field road; in a half-day's search several caterpillars of Amorbia or omnivorous looper could be found.

"Yearly applications of Aramite, Ovotran, parathion, malathion, light-medium oil, DDT, dieldrin, and wettable sulfur were made in plots of 16 trees each, in both orchards. By the end of the first year serious populations of avocado brown mite had developed in the DDT and dieldrin plots. By the end of the second year, damaging populations of *Amorbia*, omnivorous looper, and latania scale had developed in the dieldrin and sulfur plots.

"The foregoing experiments clearly demonstrate that the ill-advised use of insecticides, through destruction of beneficial insects, may intensify pest problems in avocado orchards."

The author, in concluding his paper, cites studies in progress designed to control sporadic outbreaks of particular pests by a "selective insecticide or a spray application of an insect pathogen" which would give emergency control "but have little or no detrimental effect on the efficiency of parasites and predators."

One pest that is starting to do damage in the East is the alfalfa weevil. It was imported to Utah around 1900 and then spread to the Pacific Coast and Rocky Mountain States as well as to South Dakota. Some 6 or 8 years ago a shipment of hay was sent from the West to Baltimore, with some alfalfa weevil. It has since spread in the East.

It is doing a good bit of damage in some dairy sections of Pennsylvania. In other words, a crop was transported from one region to another. The shipment came from a dry area, probably Colorado. The weevils in the shipment acclimatized themselves readily to the Eastern conditions and are now thriving here. There may have been some predators in the shipment as well, but obviously they did not survive the change of climate. Such predators in this case are three families of a small, parasitic wasp, one working as an internal parasite while the others feed externally. One of these wasp families does better in the coastal area of California, while the others prefer the more dry climates of the California desert valleys and the Rocky Mountain Area.

By now the alfalfa weevil has a good head start in the East over any predator. With the use of highly toxic sprays there is no chance for a predator to develop in sufficient quantities and the weevils' head start is thereby increased.*

It is conceded that application of manure may help the combatting of the alfalfa weevil somewhat. Would it not be advis-

*A grower writes to the Keystone Reporter, a Pennsylvania Farmers' Crop Report: "The alfalfa weevil is going to be the biggest setback for dairy farmers in this locality. Just because they took heptachlor off the market. This new marlate spray we are recommended to use is not doing the job. Everybody that used it around here cannot see good results, and it costs too much to apply frequently.

able to start feeding the alfalfa by making sure that the various nutrients needed by it are present in the soil and by applying a top-notch compost to establish a healthy soil life? It was mentioned above that virus diseases do better on hosts that suffer from malnutrition. The same result has been experienced by the author with beetles: that they thrive on crops grown on a soil deficient in nutrients and particularly on soils deficient in soil life.

Important in this connection are the structure of the soil, its organic matter and humus content, as well as the bacterial and enzymatic activity.

The best method of defense is attack. The writer is perfectly well aware that this method may not be sufficient to stop a weevil infestation at the outset. After the melting of the snow the female weevils start to lay their eggs in dead stems on the ground. Work is currently being done on the application in this connection of a spray for vegetables, similar to the B.D. Tree Spray. The problem is similar to that on the bark of a tree—namely to close up the entrances with the spray and to keep the weevil from hatching. The application will have to be done as early in Spring as possible — preferably before a Northwest wind is expected, to help give it a chance to dry. And it will have to be repeated during the growing period.

Proper treatment of the soil and sufficient and balanced fertilization are the *basic* requirements for the biological control one strives for. We also have to consider that each place has its own environment. I have visited repeatedly two gardens but a few hundred feet apart from each other. One is exposed to the open air, with good air drainage and plenty of sun. No fertilizer other than compost made with the B.D. Starter, and some made without it, has been used here.

In the place exposed to the open air, beetles have damaged the crops where insufficient care had been taken to make a good B.D. compost. In the second place better care had been taken in making the compost. It is, however, in an enclosed location, and the vegetables are more readily subjected to virus diseases, especially in a wet Summer as the past one in this region has been.

Quite different methods of approach have to be applied in these two places. Sprays such as 501 and 508 (Equisetum) would be helpful in a moist place such as the latter, while a better fertilization is essential in the place exposed to sun and air.

ANOTHER ASPECT OF CONSERVATION

Roger D. Hale, one of the pioneers in the Bio-Dynamic work in this country, has for some time now been associated with The Conservation Foundation, a non-profit organization with its headquarters in New York and centers in various parts of the U. S. A. Mr. Hale, a vice-president of the Foundation, devotes special attention to its "Graduate Training Program".

Founded in 1948, the first organization of its kind designed to carry out balanced programs of research and education in this field, its purposes are "to promote greater knowledge about the earth's resources — its waters, soils, minerals, plant and animal life; to initiate research and education concerning these resources and their relation to each other; to ascertain the most effective methods of making them available and useful to people; to assess population trends and their effect upon environment; finally, to encourage human conduct to sustain and enrich life on earth."

The program which is Mr. Hale's special concern is based on acknowledgement of the fact that "the sort of environment in which man will be living in the future will be of his own making", from which arises the need for "the training of those responsible for the management of our natural resources".

Groups of University representatives have been brought together at various conferences to develop and formulate concepts of "resource training at graduate levels".

"Encouraged by the results of the above conferences", a recent report continues, "various meetings have been held by small groups on their own initiative during the last year (1959). It is becoming more and more evident that concepts which we have joined in developing in this field are being gradually accepted. The leaven is beginning to work. More universities are taking up this type of training; others which have been in the field for some time are expanding and in many cases reorienting their methods and objectives.

"It is interesting that various industries, other than those in the business of producing forest or agricultural products but who own or use large tracts of land, are beginning to hire personnel trained in the broad aspects of resource management.

"A number of utility companies now employ resource-trained men in their Area Development Departments, indicating that such personnel are as necessary to them as economists, planners or engineers. We have heard also of certain railroads

and oil companies employing foresters, and of one large oil company employing a wildlife manager to see to it that the animal and bird life on its oil lands is properly protected. One large coal company in the middle west has a forester in its employ to direct the work of reforestation after strip mining operations.

"It appears that graduate training in resource management and use is forging ahead. But there is still much to be done in cooperation with universities and business, to the end that graduates will be most usefully trained in this field; and to attract highly gifted students. Many potential employers have yet to see how such trained personnel can be of value to them. For instance, we feel that we should periodically get the university people together with industrialists to review each other's requirements and objectives. Also, we believe that before too long it will be advisable to hold a full-fledged nationwide conference attended by top level representatives of the universities, business, industry and government. This should be a conference of national significance and should develop further awareness of the demand for trained people competent in making value judgments in the field of natural resource management.

"We believe also that there is need for a book in this field which would trace development of resource training in our universities and show its usefulness to business and industry now as in the increasingly complex future."

COMPANIES PROFIT FROM "OPEN DOOR" POLICY

Some 306,000 acres of privately-owned forest land were opened to Wisconsin deer hunters by three forest industries during the 1959 gunning season, the *Forestry Digest* reports.

As an experiment, the Consolidated Power and Paper Company, the Rhinelander Paper Company and the Goodman Lumber Division of Calumet and Hecla, Inc., encouraged hunters to hunt their lands and permitted use of 470 miles of company roads. In the Goodman area, Wisconsin Conservation Department personnel recorded 1,196 deer killed as compared to 653 in 1958.

Goodman President George Houghton, Jr., said: "The additional deer kill on our lands is worth at least $20,000 to the company during the first year." Houghton further commented: "Deer feeding on tender growth shoots of saplings do more damage to the forest than is caused by windstorms, insects or fires." *

* From CONSERVATION NEWS, a publication of the National Wildlife Federation, Washington, D. C.

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